A PROPOSAL RELATING TO ACTIONS ASSOCIATED WITH ELECTRIC POWER FAILURES

Commonwealth of Pennsylvania
STATE COUNCIL OF CIVIL DEFENSE
Harrisburg, Pennsylvania

January 1966

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COMMONWEALTH OF PENNSYLVANIA
LIEUTENANT GOVERNOR'S OFFICE
HARRISBURG

RAYMOND P. SHAFER
LIEUTENANT GOVERNOR

December 9, 1965

Dr. Richard Gerstell
Director of Civil Defense
State Council of Civil Defense
Room 20, Capitol Building
Harrisburg, Pennsylvania

Dear Doctor Gerstell:

This is in reference to House Resolution No. 148, adopted by the House of Representatives on December 1, 1965.

In accordance with our discussion of the matter, you are hereby instructed promptly to prepare, for consideration by the State Council of Civil Defense, a proposal relating to procedures to be followed in the study and planning work called for under the above mentioned Resolution.

Upon receipt of the requested proposal, I shall make appropriate arrangements for its formal consideration by the Council.

Please pursue this matter vigorously and keep me fully informed of the progress being made.

Very truly yours,

Raymond P. Shafer

RAYMOND P. SHAFER
Lieutenant Governor

RPS:ja

COMMONWEALTH OF PENNSYLVANIA
STATE COUNCIL OF CIVIL DEFENSE
HARRISBURG

January 28, 1966

Lieutenant Governor Raymond P. Shafer
Chairman, State Council of Civil Defense
Lieutenant Governor's Office
Room 200, Capitol Building
Harrisburg, Pennsylvania

Dear Governor Shafer:

In accordance with your instructions of December 9, 1965, I am submitting herewith A Proposal Relating to Actions Associated with Electric Power Failures.

The Proposal constitutes an initial response to House Resolution No. 148, adopted December 1, 1965, and is presented for consideration by the State Council of Civil Defense.

Respectfully submitted,

Richard Gerstell
Director of Civil Defense

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A PROPOSAL RELATING TO ACTIONS ASSOCIATED WITH ELECTRIC POWER FAILURES

PART I - INTRODUCTION

A major electric power failure, encompassing practically all of New York State, much of New England and a portion of the Province of Ontario, Canada, occurred November 9, 1965. This event is now commonly referred to as the "Northeast Power Failure" and is hereinafter described in some detail.

The Northeast Power Failure, involving an area of approximately 80,000 square miles and directly affecting an estimated 30 million people, dramatically spotlighted the high degree to which normal functioning of today's complex human society is dependent upon adequate and continuing supply of electric power. The occurrence also forcefully pointed up the urgent need for prompt action designed to lessen the consequences of future power failures of all sorts.

In view of the striking significance of the November power failure, Representative Paul F. Lutty (D-Allegheny) introduced in the House of Representatives of the General Assembly, on November 10, 1965, the Resolution set forth at the top of the following page.

HOUSE RESOLUTION

No. 148

On Tuesday, November 9, 1965, the worst power failure in history blacked out the great cities in the northeast and affected thirty million persons.

President Johnson has ordered the Federal Power Commission, with the help of the Federal Bureau of Investigation, to make a thorough investigation of the cause of the failure.

The dependence of our society on electric power was never made more evident. At one point, more than 850,000 people were trapped in stalled cars in New York's subway system. The possibilities of civil disorder and a breakdown in our National defense under such a power failure should now be clear to every citizen; therefore be it

RESOLVED, That the State Council of Civil Defense be directed to make a study of the possibility of such a power failure in the Commonwealth, prepare a State-wide plan of action in the event of such a power failure, and if deemed necessary to conduct drills in conformance with such a plan.

The above Resolution was referred to the Committee on Rules on November 15. It was formally adopted by the House of Representatives on December 1, 1965.

The proposal and related information hereinafter set forth have been prepared as an initial response to House Resolution No. 148 and in accordance with instructions issued by Lieutenant Governor Raymond P. Shafer, Chairman of the State Council of Civil Defense. It is presented for consideration and possible further action on the part of the Council.

Legal authority to undertake the work ordered by the Council Chairman is embodied in Section 4 of the State Council of Civil Defense Act of 1951, Pamphlet Laws 28, as amended.

PART II - HISTORICAL INFORMATION

Past records of electric power failures are clearly indicative of two key facts. First, the service standards of the electric power industry as a whole are high. Second, the great majority of recorded service failures have been of short duration, limited extent and minor significance.

In view of the facts cited above, the historical information presented below is limited to a brief descriptive listing of five major failures, or periods of failure, deemed germane to the proposal set forth in Part VI of this document.

A. Failures in Other States

During 1965, two major power failures of significance occurred in widely separated parts of the United States. Summary information concerning each of these appears immediately below.

1. The Midwest Failure

On January 28, 1965, a major power failure, involving 11 interconnected electric systems, struck most of the State of Iowa, a large part of Nebraska and smaller portions of Illinois, Minnesota, South Dakota and Wisconsin. The total area involved was somewhat larger than that encompassed by the Northeast Failure, but the number of people affected (roughly two million) and the consequent problems faced were much smaller than in the latter. The duration of outages in various localities ranged from several minutes to approximately 2½ hours.

2. The Northeast Failure

The November 1965 failure in the Northeastern States, involving 14 interconnected electric systems, affected practically all of Connecticut, Massachusetts, New York and Rhode Island, scattered communities throughout most of Vermont and a major part of New Hampshire, small segments of Northern New Jersey and Pennsylvania and a large section in Ontario, Canada. The total area within its geographical boundaries was approximately 80,000 square miles, inhabited by roughly 30 million people. The duration of outages suffered in various localities ranged from several minutes to more than 12 hours.

The basic characteristic common to the two above listed failures lies in the fact that each was caused by "interior factors", namely, an initial mechanical difficulty triggering a series of automatic responses which rapidly spread through the interconnected systems, thereby temporarily crippling them. Within the electric power industry, spreading disruptions of this type are often referred to as "cascading failures".

B. Pennsylvania Failures

During recent years, three major periods of electric power failure, each briefly described immediately below, have occurred in Pennsylvania.

1. 1955 Flood Failures

Extensive electric service failures were associated with the Eastern Pennsylvania floods of August 1955. The most seriously

affected area embraced most of Monroe, Pike and Wayne Counties, where many communities were without power for varying numbers of days.

2. Northeastern Snow Failures

Unusually heavy snows occurring in Northeastern Pennsylvania in February 1958 resulted in power failures in many parts of the area. The majority of communities most seriously affected were in Susquehanna and Wayne Counties, where a number of long continued disruptions were encountered.

3. Southeastern Snow Failures

Record snows occurring in Southeastern Pennsylvania in March 1958 were accompanied by numerous, widespread power failures. The counties most seriously affected included Berks, Bucks, Chester, Delaware, Lancaster, Montgomery and Philadelphia. Many communities within the area were without power for periods longer than 72 hours.

Two features characterize the three above listed periods of failure. First, the disruptions were the direct result of "outside factors", namely, physical damage of facilities and equipment by the forces of nature. Second, the comparatively long duration of the failures was in many instances due to the fact that washed-out bridges and snow-clogged highways rendered it impossible for emergency work crews quickly to reach damaged facilities to repair them.

PART III - DETAILS OF THE NORTHEAST FAILURE

Because they provide an insight into the problems associated with major electric failures, certain of the details of the Northeast Power Failure are summarized below.

Many of the facts presented have been drawn from the document entitled, "Northeast Power Failure, November 9 and 10, 1965, A Report to the President by the Federal Power Commission, December 6, 1965". Use of this material is hereby gratefully acknowledged.

A. Nature

Electric power is furnished to New York, New England and Southern Ontario by more than 30 principal utility organizations. Their systems and facilities are linked together in various ways to form what is known as "The Canada - United States Eastern Interconnection". This vast complex was normally supplying power to the area late in the afternoon of November 9, 1965.

At 5:16 P.M. on that date, an equipment protection relay at Niagara Falls, Ontario operated to trip a circuit breaker. This cut off one of five transmission lines carrying power northward to the Toronto area, from generating plants on the United States and Canadian sides of the Niagara River.

Power from the cut-off line was automatically shifted to the remaining four lines. This overloaded the latter and their protective relays and breakers successively shut each of them off. All this occurred in about $2\frac{1}{2}$ seconds.

Shut-off of the five Toronto lines immediately reversed the flow of power, upset the Niagara generating plants and placed much added power on the transmission system in Western New York. This sudden thrust of electricity automatically activated additional relays and circuit breakers, thereby cutting off, or isolating, various parts of the last mentioned system.

The disruptions in Western New York were quickly followed by trip-outs both of transmission lines feeding Southern New York and New England and of a number of generators at various points. Further rapidly following events soon resulted in essentially total service failure throughout all of New York State and much of New England.

All of the cited events took place very rapidly, some simultaneously. Within a period of approximately 12 minutes, all of The Canada - United States Eastern Interconnection, except that portion feeding Maine and Eastern New Hampshire, had, to all practical intents and purposes, "gone dead".

In brief, the Northeast Failure was the end result of a rapidly occurring chain of self-initiated mechanical events, combined in part with human failure, or inability, promptly to act to counter the mechanical occurrences to the degree at least theoretically possible.

B. Area and Duration

As previously indicated, the Northeast Failure encompassed an area of approximately 80,000 square miles, including parts of eight Northeastern States and one Canadian Province. This area is shown in Figure 1 at the top of the following page.

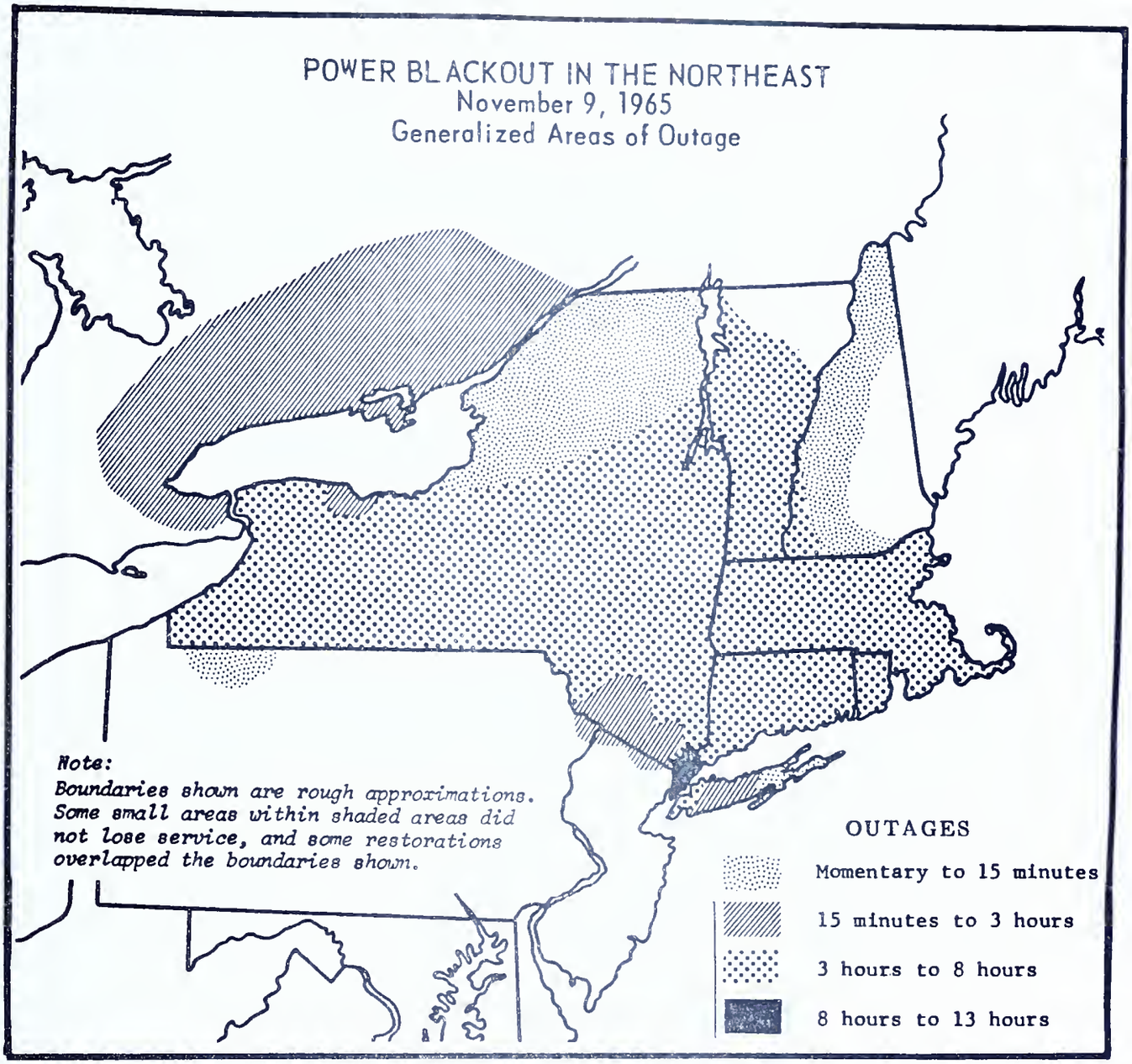

Figure 1

The map presented above depicts the general area of the Northeast Power Failure and indicates the approximate duration of the service failures in various parts of the affected states. It was prepared by the Federal Power Commission and originally appeared in that agency's December 6, 1965 Report to the President. Commission authorization to reproduce the figure is hereby gratefully acknowledged.

The whole of the affected area was not subjected to total blackout. Even in New York State, for example, a few communities, notably those served by certain hydro-electric plants, suffered no outages. In addition, disruptions in Vermont and New Hampshire were spotty.

As indicated in Figure 1, above, the duration of the power

outages suffered in different localities ranged from a few minutes to almost 13 hours. This time spread reflects, in the main, wide variations in the number and complexity of the problems faced in properly and safely reactivating electrical equipment and facilities which have temporarily "gone dead". These difficulties are, of course, greatest in the larger and more complex systems, such as that serving New York City.

C. Effects

While other failures have encompassed larger areas and have been of longer duration, the Northeast Failure was by far the Nation's most serious in terms of the number of people affected. Its human consequences tended to be maximized by the fact that it occurred after dark and when millions of people were on their way home from work. On the other hand, the effects were lessened to some degree by the fact that the weather was mild and a bright moon shown through most of the night.

Some of the more significant relationships of the failure to human activities are briefly described below.

1. Communications

A large number of radio broadcasting stations having emergency power generators were able to resume operations within a very short time after start of the failure. However, the over-all effectiveness of their emergency information dissemination activities was greatly reduced by the fact that commercially-powered home receivers were inoperable. Only battery-powered receivers, mainly portable units and those in automobiles,

remained operable during the blackout.

Most television stations in the blackout area were inoperable throughout the failure, because their operation is normally dependent upon commercial power. A few emergency-powered stations in the Boston area continued to broadcast, while some New York stations remained on the air by shifting operations to points outside the affected area. This potential means for the dissemination of emergency information and instructions was largely ineffective, because the great majority of receivers within the blackout area were rendered inoperable by lack of power.

Telephone communications were maintained throughout most of the affected area, but some localities in Upper New York and New England were without service for brief periods. The continued high effectiveness of this service was due both to the existence of emergency power equipment for key facilities and to the use of "line load control", an emergency measure designed to assure priority for essential traffic.

Telegraph service delays in different localities varied from a short time to as long as 14 hours. Commercially-furnished, private-wire teleprinters and facsimile equipment could not be operated, regardless of the use of emergency power at telegraph stations. Most essential intergovernmental service, including that to points overseas, remained operable, or was restored within a short time. However, service to several military installations was disrupted for a time.

In the over-all, it would appear that continued radio broadcasting and the maintenance of telephone service strongly tended to minimize public confusion and to reduce the liklihood of serious panic.

2. Transportation

In New York City, roughly 600 subway trains carrying more than 600,000 passengers were halted and the system remained inoperable for about 15 hours. Some 10,000 people were still in stalled trains at midnight, while 1,700 others were stranded for five hours on a bridge over the East River. On the other hand, the Boston subway system continued to operate, because it normally utilizes its own power generating facilities. On other occasions, however, this system has had to draw emergency operating power from commercial sources.

Being electrically powered, practically all railroad service in New York City was halted. The principal exception was part of the Pennsylvania Railroad, which draws power from an unaffected utility in New Jersey. Throughout the remainder of the blackout area, rail operations were seriously hampered, due to the fact that operation of most signal and switching facilities are dependent upon commercial power.

Air transport in major service areas was grossly disrupted, but fortunately no accidents resulted from the failure. In the New York City area, control towers, field lighting, navigational aids and radar equipment at the Kennedy International

and LaGuardia Airports were without power and inoperable for a period of almost 12 hours. After two hours, limited service was resumed at LaGuardia, where a water-pump generator was used to provide emergency lighting for one runway. Somewhat similar conditions prevailed at the Boston Airport, where standby power facilities permitted control tower communications with aircraft, but the field lighting failed. Federal air route traffic control centers at New York and Boston, which control the general movement of aircraft, as contrasted to airport take-offs and landings, shifted to their standby power sources and continued in full operation. This permitted through traffic to move normally and aided in the diversion of aircraft from closed to operational airports, mainly to facilities outside the blackout area.

Motor traffic on rural highways continued to move, but in many metropolitan and suburban areas, the flow was seriously disrupted and jammed, due to the fact traffic control signals were inoperative.

3. Human Care Institutions

More than 850 hospitals within the blackout area are known to have been without commercial power. However, with the exception of those in the New York metropolitan area, practically all had emergency lighting or power facilities of some sort and no patient deaths directly attributable to the power failure have been reported. Out of roughly 150 hospitals in New York

City, less than half had adequate emergency power. Police and fire departments were called upon to furnish many hospitals with portable generating units for emergency use.

Except for a comparatively small percentage equipped with emergency power facilities, most other human care institutions were thrown into darkness for varying periods of time. This posed many problems, but no grave consequences have been reported.

4. Public Services

Street lighting facilities in most communities in the blackout area were temporarily inoperative. As previously indicated, however, this effect was partially offset by bright moonlight conditions.

Public water supply and sewage system operations dependent upon electrically-powered pumping facilities were subject to some disruption, but few major problems were encountered. In the Jamaica section of Queens, New York, the water system was out of service for roughly six hours, while water pumping difficulties of shorter duration were faced at a few points in Western Massachusetts.

Police and fire operations in the blackout area were not seriously restricted by the loss of power. In some localities, lack of emergency power generators for radio base stations disrupted normal departmental communications, but this was

in most cases overcome through the use of transmitter-receiver units in motor vehicles. In addition, police field operations in some communities were curtailed because of inoperative electrically-powered gasoline pumps used to fuel patrol cars. The inability to pump gasoline from underground storage tanks also caused some disruption of other motor transportation of various types.

Elevator service in public and private buildings in most of the blackout area was brought to a halt for varying periods of time. In tall structures in the metropolitan areas, this frequently presented serious problems, particularly where people were trapped in stalled cars.

5. Defense Activities

Military and civil defense activities within the blackout area were adversely effected only to a very limited degree. Major defense warning and communications systems incorporate emergency power facilities and consequently remained operative.

As hereinafter briefly mentioned, certain civil defense communications facilities constituted one of the principal means for the collection and dissemination of emergency information within the affected area (Sub-part D, below, and Part V A, following).

6. Business, Industry and Commerce

Business, industry and commerce were adversely affected by the blackout, but the over-all impact of the failure on these

activities is difficult to measure. Many delays and disruptions of varying degrees of importance were experienced, but these effects were minimized by the fact that the failure occurred at night, when the great majority of business, industrial and commercial firms are normally closed.

7. Home Life

Life in millions of homes within the affected area was grossly disrupted, but the seriousness of the effects varied widely, depending upon the duration of the failure within different localities.

Lack of lighting was the primary problem faced in dwelling places of all sorts. Only a negligible number of rural homes have emergency power facilities and a large percentage of all dwellings apparently were entirely without flashlights, candles or other emergency lighting devices.

Many dwellings, supplied by private wells with electrical pumping facilities, were without water for drinking, cooking and sanitary purposes, for varying periods of time.

Failure of home heating and food refrigeration devices presented potentially serious problems, but these were minimized by mild weather and the comparatively short duration of the power lack in many communities.

Another potentially serious home problem was the widespread lack of essential information concerning the true nature of the

emergency faced. This stemmed largely from the fact that commercially-powered home radio and television receivers were inoperable. Its gravity was lessened to a degree both by the general maintenance of telephone service and by the comparatively short duration of the blackout in many localities.

8. Public Behavior

Public response to the emergency was highly creditable. Contrary to some early news reports, there were no public disturbances of significance and early reports indicate that the crime rate dropped somewhat during the blackout period.

During the early hours of the power failure, several hundred prisoners rioted in a Massachusetts State Penitentiary, but the exact relationship of this occurrence to the blackout is difficult to determine.

Police, fire, civil defense and other governmental agencies, together with non-governmental organizations both paid and volunteer, rendered outstanding emergency services. The ingenuity exercised both by their members and by individual citizens frequently proved highly effective.

D. Pennsylvania Activities

Fortunately, only very small portions of three Northern Pennsylvania counties were directly affected by the Northeast Failure and outages in those localities lasted only a very brief time.

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[illegible]

[illegible]

[illegible]

[illegible]

However, occurrences in the Northeastern States promptly triggered a number of emergency actions in Pennsylvania. Some of the more important of those taken during the early evening of Tuesday, November 9, 1965, are briefly described immediately below.

Since initial direct effects of the Northeast Failure on Pennsylvania were of very minor consequence to people within the State, policies of the several Commonwealth departments and agencies concerned with emergency operations called for the immediate transmission of no emergency reports to Harrisburg.

About 6:15 P.M., the State Director of Civil Defense heard a brief radio news report to the effect that a power failure in the New York metropolitan area had tied up the normal homeward flow of people in the area. Having previously received no reports of difficulties within the Commonwealth, no action was taken at the time.

Shortly before 6:30 P.M., a Presidential Assistant at the White House in Washington talked with Governor Scranton by telephone. The former reported that information available to him was to the effect that a vast area, extending northeastward from Harrisburg and Philadelphia through the Northeastern States, had been blacked out by a power failure of undetermined cause. He offered Federal assistance in the emergency, if required.

Immediately thereafter, the Governor jointly talked with the Secretary to the Governor and the Director of Civil Defense. He told them of the information received from the White House, together with the fact that he had just heard a newscast reporting serious civil disturbance and

looting in Rochester, New York. Further, he instructed the two officials to determine the nature and extent of possible problems in Pennsylvania, to initiate any immediate action required to protect life and property and to keep him fully informed of developments.

At approximately 6:35 P.M., the Western Area Director of the State Council of Civil Defense at Butler, Pennsylvania reported to the State Director. He stated that a Western Pennsylvania television station had recently carried a news broadcast to the effect that Harrisburg, Philadelphia, New York and New England were blacked out by unknown causes. He further stated that a preliminary check of conditions had disclosed no difficulties in Western Pennsylvania and asked whether assistance was required in the eastern part of the State.

About the same time and in accordance with the Governor's instructions, the State Director and the State Defense Council's Operations Officer inaugurated action to obtain full and accurate information concerning Pennsylvania conditions and the possible need for further emergency action. In addition, the Secretary to the Governor assumed responsibility for answering inquiries then beginning to flow into the Governor's Office by telephone. He also monitored news broadcasts relating to the emergency.

To obtain essential situation reports, civil defense representatives utilized both a portion of the National Warning System and telephonic communications.

The National Warning System is a nationwide civil defense facility linking the Headquarters of the North American Air Defense Command at Colorado Springs, Colorado with the several States. It is

an open-circuit, voice system with stand-by power equipment which automatically cuts-in whenever normal power sources fail. It is operable at all times and is tested daily.

National System facilities within Pennsylvania connect the State Civil Defense Emergency Operations Center in the basement of the Capitol Building at Harrisburg with the National Warning Center, with Regional Headquarters of the Federal civil defense agency and with other States. It also links the State Center with the State Defense Council's three Area Headquarters and with the 15 Troop Headquarters of the Pennsylvania State Police.

By utilizing the intra-state portion of the National System for a so-called "conference call" to all State Police Troop Headquarters, it was possible to learn within several minutes that no problems of significance were then faced in Pennsylvania. Up to that moment, only one brief outage in the vicinity of New Milford, Susquehanna County, had been reported. However, a number of Troop representatives stated that they were closely following the situation in New York and New England, by monitoring out-of-state traffic being carried by the System.

Following emergency mutual aid procedures long previously agreed upon by the Defense Coordination Committee of the Pennsylvania Electric Association and the State Council of Civil Defense, telephone was used to obtain operational reports from key electric utility companies within the State. In brief, these were to the effect that there had been no major disruption of consumer service within the Commonwealth and that there was no reason to believe that difficulties to the north subsequently would spread southward into the State.

Based on the actions outlined above and approximately 45 minutes after receipt of the White House call, it was possible to assure the Governor that Pennsylvania faced no major problems, actual or anticipated.

To counter continued news broadcasts to the effect that a large part of Pennsylvania was blacked out, the Governor's Press Secretary issued a special news release shortly before 8:00 P.M. This set forth the true facts and carried the Governor's pledge of Commonwealth assistance to the people of any Pennsylvania community which subsequently might be in need of help as a result of future spread of the Northeast Failure.

State civil defense representatives at Harrisburg continued to monitor out-of-state traffic on the National Warning System until approximately 10:00 P.M. Since the information gained was indicative both of no spread of past difficulties and of progress in restoring service in many parts of the affected area, State emergency operations were then terminated.

In Pennsylvania, indirect effects of the Northeast Failure were experienced primarily in the City of Philadelphia. During the early evening hours, a large number of commercial aircraft bound for New York City were diverted to the Philadelphia International Airport, where their landing was handled with efficiency and dispatch. In addition, City officials and police, ably assisted by local transport and hotel representative, rendered outstanding public service in assisting large numbers of unexpected passengers to reach their destinations as promptly as possible.

PART IV - GOVERNMENTAL PROBLEMS AND RESPONSIBILITIES

The basic governmental problems and responsibilities associated with possible major power failures occurring within the Commonwealth can perhaps be most readily visualized by considering what might have transpired had the Northeast Power Failure encompassed Pennsylvania.

For this purpose, there are presented below a few selected examples of the problems and responsibilities likely to have been directly and indirectly faced by governmental departments and agencies under the hypothetical situation mentioned immediately above. These are grouped under three headings, each reflecting varying types and degrees of governmental responsibilities.

A. State

Under the assumed situation prescribed above, departments and agencies of the Commonwealth Government would in all probability have faced, among many others, the following described problems occurring at the below listed installations and facilities.

1. Capitol Park Complex

With two partial exceptions, the Capitol and all other Commonwealth structures in Capitol Park at Harrisburg would have been plunged into darkness, with elevator service at a standstill. The two exceptions would have been the State Council of Civil Defense Emergency Operations Center and the State Police Communications Center. The former is located in the Capitol basement, the latter in a rented structure bordering on the

Park. Both of these facilities are equipped with stand-by generators which automatically would have been activated and would have produced the power necessary for lighting and essential emergency communications service (Part V A, Sub-paragraphs 1 and 3, following).

2. Human Care Institutions

A number of those human care institutions under jurisdiction of the Departments of Health and Public Welfare doubtless would have faced serious operational problems stemming from limited emergency lighting and power facilities. Several might have been almost totally blacked out, as was the case during the heavy snows of early 1958.

3. Educational Institutions

Some State Colleges, where large numbers of students are in residence, probably would have faced serious operational disruptions due to limited emergency lighting and power facilities.

4. Other Facilities

Many Commonwealth administrative offices and facilities scattered throughout the State, a large percentage of them in rented space, would have been without light or heat. Departmental and agency radio and teletypewriter systems would have been subject to disruption at those points where base and relay stations and terminal facilities are without emergency power units. Numerous

State highway bridges, tunnels and interchanges would have been without overhead lighting, while directional signs would have been darkened and traffic control signals rendered inoperable. Operation of essential State patrol and maintenance vehicles within some localities might have been restricted due to inability to pump gasoline from underground storage facilities.

Possible problems of the types cited immediately above obviously would both seriously and adversely affect the safety and welfare of large numbers of citizens of the State. The Commonwealth Government, accordingly, holds certain basic responsibilities directly associated with such problems. These responsibilities relate primarily to consumer services furnished by State-certificated utility companies, to emergency lighting and power for State-owned installations and facilities and to emergency policies, plans and procedures of various Commonwealth departments and agencies.

B. County and Local

Under the assumed conditions, numerous county, city, borough, town and township governments throughout the State theoretically would have been confronted by numerous problems generally similar to those likely to have been faced by the Commonwealth. A few typical examples are cited immediately below.

Many key county and municipal structures, including administrative buildings, human care institutions, fire and police stations and others, would have been without light or heat. Some public water supply and sewage systems dependent upon electrical pumping operations possibly

would have been inoperable. Serious highway traffic disruptions doubtless would have been faced in many communities, due to inoperative traffic control signals.

With respect to problems of the type last mentioned, county and local governments hold basic responsibilities much the same as those of the Commonwealth Government. These relate to emergency lighting and power for key county and local installations and facilities and to departmental and agency emergency policies, plans and procedures relating to public safety and welfare.

C. Other

In the assumed situation, the problems theoretically faced by business, industrial and commercial organizations and by householders in Pennsylvania doubtless would have been basically the same as those actually confronted in the Northeastern States on November 9 and 10, 1965 (Part III C, preceding).

In relation to those particular problems, two basic responsibilities are jointly held by State, county and local governments. One is to see to it that members of the public at large are kept fully informed of the true nature of the situation faced and are promptly provided with essential information concerning the actions they properly should take on their own behalf. The second is to be prepared immediately and effectively to act to counter any and all problems affecting public safety and welfare.

PART V - PRECAUTIONARY MEASURES PREVIOUSLY TAKEN

The fact that a major power failure of the type which struck the Northeastern States in November 1965 would, as previously cited, both seriously and adversely have affected Pennsylvania is by no means indicative of neglect to give consideration to such possible exigencies. On the contrary, numerous public and private agencies and organizations throughout the Commonwealth have long since taken positive steps to counter the possibility of electric power failures stemming from various causes. For illustrative purposes, a few examples of the actions taken are presented below.

A. State

The following listed Commonwealth departments and agencies hold primary emergency operational responsibilities relating both to natural disasters and to enemy attack. To offset the possible effects of commercial power failures, each has taken the precautionary measures cited below.

1. State Council of Civil Defense

Since its legal creation in 1951 and largely to assure continued operation of those emergency communications facilities required to disseminate attack warnings, to collect essential information and to direct relief operations, this agency has taken a number of steps designed to counter the effect of possible commercial power failures. Some of the more important of these are outlined immediately below.

The agency's statewide, electronic warning system, known as the

Bell-and-Lights Instantaneous Warning System and initially contracted for in late 1951, is fitted with stand-by battery power sources. These automatically cut-in and supply power in the event normal commercial sources should fail.

In 1952, a number of small, portable, gasoline-driven power generators were purchased, with Federal financial assistance. Some of these originally were used by the agency and others were loaned to county civil defense agencies, to power the few key civil defense emergency communications facilities then available. As communications systems were expanded and more adequate generating equipment was obtained, most of the small units were gradually withdrawn and are now kept in the agency's emergency stockpile, ready for immediate transport to points where they may be temporarily needed.

Also in 1952, a small, self-powered, portable radio transmitter-receiver unit was obtained by the agency for use by the Pennsylvania State Police, to increase the last mentioned agency's emergency communications capabilities. (Should a major power failure have occurred prior to that time, State Police radio communications would have been limited to traffic carried by mobile units installed in motor vehicles, as operation of all agency base stations was then dependent solely upon commercial power sources.)

In 1957, the agency, in cooperation with the Pennsylvania State Police, assumed responsibility for 'round-the-clock manning and

operation of the intra-state portion of the National Warning System (Part III D, preceding). This open-circuit, voice system provides means of direct communications between Harrisburg and the agency's three Area Headquarters, together with State Police Troop Headquarters throughout the Commonwealth. Having stand-by power facilities, the system remained operative and was effectively used during the extended power failures associated with the heavy snows of early 1958. In addition and as evidenced by the system's emergency use in New England in connection with the Northeast Power Failure, the Pennsylvania segment of the system would have remained operable had that failure encompassed the State.

In 1958, the agency purchased special generators for its Harrisburg and three Area Emergency Operations Centers. These units provide emergency power for lighting, warning and communications purposes. Those at the Eastern and Western Area Headquarters are mounted on wheeled trailers, thus making it possible quickly to move them to other points for temporary emergency use, if so needed.

During recent years, the agency has obtained, through donations under the Federal Surplus Property Program for Civil Defense, a limited number of medium-size, skid- and trailer-mounted power generators. These are kept at the agency's emergency stockpile, ready for immediate transport to points where they may temporarily be needed. The agency also has access, contingent upon Federal approval, to limited numbers of similar units in a Federal civil defense stockpile in Cumberland County, Pennsylvania. A number

of the latter were made available for use by local communities during the floods of 1955, the 1958 snows and more recent drought emergencies.

In addition, the agency directly and indirectly has acted to provide financial assistance to other Commonwealth departments, for use in the purchase of emergency power generators (Sub-paragraphs 3 and 4, below).

2. Department of Military Affairs

This department's new Command Headquarters of the Pennsylvania National Guard, located at the Indiantown Gap Military Reservation, is equipped with an emergency power system. In the event of commercial failures, this provides power for lighting, communications and other essential services and functions.

3. State Police

Beginning in 1959, this department purchased and installed emergency power generators at its Harrisburg Communications Center and most Troop Headquarters throughout the State (the exceptions are several facilities not located in State-owned properties). These units provide emergency power for both lighting and communications purposes. In addition, the agency purchased one small, portable generator for field use within each Troop Area. The cost of these units was divided as follows: 25% was paid by the agency; 25% was contributed by the State Council of Civil Defense, in recognition of State Police

assistance in operating certain Council warning facilities; and 50% was contributed by the Federal Government, through the Council and under the Federal Contributions Program for Civil Defense Facilities, Equipment and Supplies.

4. Department of Highways

Beginning in 1959, this department purchased and installed emergency generators at each of its County Maintenance Buildings. These provide power for essential lighting and for operation of radio base stations and gasoline pumps. The agency paid 50% of the total purchase and installation costs, while the remaining 50% was contributed by the Federal Government, through the State Council of Civil Defense and under the Federal Contributions Program for Civil Defense Facilities, Equipment and Supplies.

5. Turnpike Commission

To assure continued safe operation of the Turnpike System under emergency conditions, this agency has installed emergency generators serving all its key operating facilities. The latter include tunnels, interchanges, maintenance buildings and the agency communications network.

6. Aeronautics Commission

This agency owns and operates two major facilities regularly used by commercial air carriers, namely, the Harrisburg-York and the Mid State Airports. At the former, the control tower, navigation aids, field lighting system, hangars and terminal

building are all served by stand-by generators. At the latter, only the control tower and navigation aids presently are equipped with emergency generators.

A number of other Commonwealth departments and agencies have acted to counter the effects of possible power failures on some key installations and facilities under their jurisdiction. A few major institutions have electric generating plants and some have stand-by, motor-driven generators. These are capable of meeting at least minimum essential emergency requirements. Many other facilities, including the Capitol Building, have connected alternate, or stand-by, commercial power sources, which automatically cut-in should the normal source fail. The latter are usually effective in localized failures, but would be ineffective in the event of major failures of the type which occurred in the Northeastern States last November.

In addition, the Fire and Panic Act of 1927, Pamphlet Laws 465, as amended, provides, except within cities of some classes, that certain spaces within specified types of structures wherein people are employed, housed or assembled shall be equipped with emergency lighting facilities of approved design.

The excepted cities are those of the first and second classes and second class A, namely, Philadelphia, Pittsburgh and Scranton.

The types of structures covered, with some exceptions based in part on height in stories and numbers of occupants, include, among others, factories, mercantile buildings, hotels, office buildings, hospitals, public and private institutions, convalescent and nursing homes, schools,

colleges, dormitories, theaters, public assembly halls, apartment buildings and rooming and lodging houses.

The spaces for which emergency lighting is required include, among others, corridors, stairways, exit ways, dining and assembly halls, hospital operating rooms, projection booths, main switchboard rooms and boiler rooms.

The required emergency lighting facilities may be powered either by batteries or by generators, but must be of types and designs approved by the State Department of Labor and Industry's Bureau of Industrial Standards and Industrial Board. That department is legally charged with over-all responsibility for administration of the Fire and Panic Act.

Emergency lighting facilities of the type required under provisions of the Fire and Panic Act must automatically cut-in within 15 seconds immediately following failure of normal power supplies and must be capable of operation for a minimum period of $1\frac{1}{2}$ hours. They have proven to be of great value in past power failures in Pennsylvania and probably would be of even greater benefit in the event of a major failure similar to that which occurred in the Northeast last November.

B. County and Local

Many county and local governments throughout the Commonwealth have also acted to guard against the possible effects of electric power failures.

For example, some political subdivisions have installed electric generators both in essential administrative and in human care facilities

under their jurisdiction. In addition, the great majority of county and numerous local civil defense emergency operations centers are fitted with stand-by power units. Similarly, practically all base stations within the various county-wide civil defense warning and communications networks throughout the State have emergency power facilities. Likewise, many police and fire departments have installed emergency equipment which powers their essential operational facilities.

The benefits accruing from the above cited actions have been clearly demonstrated during past power failures. Because of the precautionary measures taken, it has in many cases been possible to continue human care and other essential day-to-day governmental activities without serious disruption. In addition, the immediate availability of emergency power has permitted continued functioning of those governmental communications facilities essential to effective direction and control of those emergency operations required to protect life and property.

Further, a number of subdivisions, notably the City of Philadelphia, have adopted ordinances requiring the installation of emergency lighting facilities in public buildings, hospitals, theaters and similar structures. The provisions of these are generally similar to those of the aforementioned Fire and Panic Act and have proved to be equally effective.

C. Other

A number of public and private hospitals throughout the State have long since installed electric power generators for emergency use. These not only meet the minimum requirements for emergency lighting, but

also are capable of supplying the power required for the continuation of essential services, including the operation of respirators and other specialized types of medical apparatus, as well as refrigerators, elevators and other engineering equipment.

Some industrial and commercial organizations also have installed emergency power units of various types and sizes. These too provide not only for emergency lighting, but also for the operation of production control and safety devices, pumps, heating and cooling units and other types of key equipment. Many of those without generators have connected stand-by, or alternate, commercial power sources, usually effective in localized failures.

Appreciable numbers of Pennsylvania farms, principally the larger units, have small portable or tractor-associated generators. These are normally used for various types of regular farm work, but also are capable of providing light and power in times of emergency.

Largely because of hardships experienced during the extended power failures associated with the heavy snows of 1958, a few householders have installed small, motor-driven generators for home use. The majority of these units are in suburban dwellings where electricity is essential to heating, supply of well water, cooking and other day-to-day needs.

Emergency facilities of the types cited above have proved very effective in past localized failures. They would be equally effective in the event of major failures.

PART VI - PROPOSAL

The information herein presented, notably that set forth in Parts III and IV, preceding, clearly would seem to indicate that the potential gravity of possible problems associated with electric power failures is such as to warrant four principal courses of further action on the part of the Commonwealth Government.

First, the emergency operational policies, plans, procedures and capabilities of State-certificated electric utility companies should be carefully reviewed from the standpoint of possible practical improvements.

Second, the adequacy of emergency lighting and power for all key installations and facilities under the jurisdiction of various Commonwealth departments and agencies should be evaluated in the light of possible need for corrective measures.

Third, the emergency operational policies, plans and procedures of the several Commonwealth departments and agencies should be reviewed from the standpoint of possible improved coordination and effectiveness.

Fourth, the adequacy of available emergency information and the means for its public dissemination should be evaluated with a view toward improved effectiveness, speed and coverage.

If collected and presented in a generally similar manner, facts derived from the four courses of action listed immediately above would provide the basic information essential to the development of over-all, fully coordinated policies, plans and procedures of the type necessary

most effectively to counter the possible problems associated with electric power failures. Further, the development of such policies, plans and procedures would meet the requirements placed upon the State Council of Civil Defense by House Resolution No. 148, adopted December 1, 1965 (Part I, preceding). Still further, under the provisions of Section 4 of the State Council of Civil Defense Act of 1951, Pamphlet Laws 28, as amended, the said Council is specifically authorized not only to undertake, supervise or direct the making of studies of the type in question, but also to require and direct the cooperation and assistance of other State officials and agencies.

Therefore, to obtain the information and data essential to the development of plans, policies and procedures of the type called for under the aforementioned House Resolution and in consonance with the provisions of law cited immediately above, it is proposed that the State Council of Civil Defense take the primary actions outlined below.

A. Other Departments and Agencies

With reference to basic responsibilities of other departments and agencies of the Commonwealth Government, it proposed that the Council:

1. Request the Public Utility Commission to continue, with active cooperation on the part of State-certificated public utility companies, its review of the emergency operational policies, plans, procedures and capabilities of those organizations; and, further, to submit essential information on the subject to the Council, as appropriate.

2. Request the Administrative Heads of the several departments and agencies listed below to study and report, in accordance with general information and instructions subsequently to be furnished by the Council through the Director of Civil Defense, on the adequacy of emergency lighting and power facilities at the indicated installations and sites under their respective jurisdictions.

a. Department of Agriculture

State Farm Show Building at Harrisburg.

b. Department of Forests and Waters

Key field installations and facilities, including particularly those associated with the conduct of forest protection, flood forecasting and State Park operations.

c. Department of Health

Key field installations and facilities, including particularly State hospitals, clinics and other facilities where patients are housed.

d. Department of Highways

Key field installations and facilities, particularly those associated with the conduct of emergency operations.

e. Department of Justice, Bureau of Corrections

Key field installations and facilities, notably State

Correctional Institutions.

f. Department of Labor and Industry

State Rehabilitation Center at Johnstown.

g. Department of Military Affairs

Key headquarters and field installations, particularly those associated with the conduct of emergency operations, together with the Soldiers' and Sailors' Home at Erie.

h. Department of Property and Supplies

Key installations and facilities at Harrisburg, including specifically vaults and similar facilities under immediate jurisdiction of the State Treasurer, together with the State Office Buildings at Philadelphia and Pittsburgh.

i. Department of Public Instruction

Key field installations and facilities, including particularly State Colleges, the State Oral School for the Deaf, the Scotland School for Veterans' Children and the Thaddeus Stevens Trade School, together with educational television facilities which might be used for public dissemination of emergency information and instructions.

j. Department of Public Welfare

Key field installations and facilities, including particularly State General and Mental Hospitals, State Schools and Hospitals, Youth Development Centers and Forestry Camps and other facilities where large numbers of people are housed.

k. State Police

Key headquarters and field installations and facilities, particularly those associated with the conduct of emergency operations.

l. Liquor Control Board

Key field installations and facilities, including warehouses and stores.

m. Turnpike Commission

Key headquarters and field installations, particularly those associated with the conduct of emergency operations.

n. Aeronautics Commission

Key headquarters and field installations and facilities, particularly State airports used by commercial aircraft.

o. Delaware River Joint Toll Bridge Commission

Key headquarters and field installations and facilities,

notably bridges.

p. Game Commission

Key headquarters and field installations and facilities, including particularly communications facilities essential to effective support of civil defense emergency operations.

q. Historical and Museum Commission

Key field installations and facilities, notably buildings frequented by large numbers of visitors.

r. Delaware River Port Authority

Key headquarters and field facilities, notably bridges.

3. Request the Secretary of Labor and Industry, through the Department's Bureau of Industrial Standards and Industrial Board, to review and report on the adequacy, effectiveness and degree of compliance with emergency lighting regulations adopted pursuant to the provisions of the Fire and Panic Act of 1927, Pamphlet Laws 465, as amended.

4. Request the Executive Director of the General State Authority to review and report on the adequacy of agency policies relating to the incorporation of emergency lighting and power facilities in structures designed and built under the agency construction program.

B. Council Staff Organization

With reference to basic responsibilities of the Council itself, it is proposed that the Council formally instruct the Director of Civil Defense, assisted by agency staff personnel and other indicated organizations and individuals, promptly to:

1. Review and report on the adequacy of emergency lighting and power facilities at key agency installations and facilities, including all essential warning and communications systems and networks.

2. Review and take appropriate steps, with requested cooperation on the part of the Defense Coordination Committee of the Pennsylvania Electric Association, to improve mutual assistance policies, plans and procedures relating to the emergency reporting of major service difficulties and to actions aimed at their correction, the same to include a brief report of the actions taken.

3. Develop and arrange for appropriate dissemination, with requested cooperation on the part of the Defense Coordination Committee of the Pennsylvania Electric Association, of emergency information concerning household and individual actions to be taken in the event of commercial power failures, the same to include a brief report of the work accomplished.

4. Review and take appropriate steps, with requested cooperation

on the part of the Bell Telephone Company of Pennsylvania and Associated Independent Companies, to improve mutual assistance policies, plans and procedures relating to emergency reporting of major service difficulties and to actions aimed at their correction, the same to include a brief report of the actions taken.

5. Review and take steps, with requested cooperation on the part of the Bell Telephone Company of Pennsylvania and Associated Independent Companies, to assist, as appropriate, in developing increased effectiveness of so-called "line load control", or other priority emergency services provided by the several companies, the same to include a brief report of the actions taken.

6. Review and take steps, with requested cooperation on the part of the State Industry Advisory Committee and Pennsylvania Radio and Television Broadcasters, to improve the State Emergency Broadcast System authorized under regulations of the Federal Communications Commission.

7. Follow and periodically report, as appropriate, on current and future Congressional actions relating to commercial power failures, the same to include essential information concerning the possible availability of Federal financial assistance in the purchase and installation of emergency lighting and power equipment and facilities.

8. Based both on reports filed by other Commonwealth departments and agencies in accordance with the provisions of Sub-part A, immediately above, and on other available information and data, prepare and submit to the Council materials deemed to be of assistance in subsequent formal Council adoption of policies, plans, procedures and recommendations relating to State, county and local emergency actions associated with electric power failures.

In conclusion, and with particular reference to the proposed actions enumerated above, the following facts are deemed to be of signal importance:

The over-all value and effectiveness of policies, plans and procedures relating to emergency measures associated with electric power failures, including those both precautionary and remedial in nature, will be directly dependent upon the validity of the information and data on which they are based. All stated requirements and objectives must, accordingly, reflect minimum and realistic essentials, as contrasted to impractical ideals.

For example, there is a vast difference in the cost and capabilities of emergency lighting and emergency power facilities and the former must not be confused with the latter. Comparatively inexpensive battery-operated emergency lights will satisfy the requirements for most administrative facilities, but far more expensive stand-by generating equipment frequently may be required in hospitals, communications centers and other specialized facilities, where continuation of essential services

creates a relatively heavy demand for power.

In brief, the possible problems associated with electric power failures must be viewed in carefully considered perspective and not solely in the light of either maximal or minimal extremes.

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